

DECLARATION

I, Toshio Morita, c/o Fukami Patent Office, Nakanoshima Central Tower,
22nd Floor, 2-7, Nakanoshima 2-chome, Kita-ku, Osaka-shi, Osaka, Japan,

declare:

that I know well both the Japanese and English languages;

that to the best of my knowledge and belief the English translation
attached hereto is a true and correct translation of Japanese Patent Application
No. 10-338658, filed on November 30, 1998;

that all statements made of my own knowledge are true;

that all statements made on information and belief are believed to be true;

and

that the statements are made with the knowledge that willful false
statements and the like are punishable by fine or imprisonment, or both, under 18
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Dated: December 10, 2008



Toshio Morita

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in this Office.

出 願 年 月 日

Date of Application:

1998年11月30日

November 30, 1998

出 願 番 号

Application Number:

平成10年特許願第338658号

Pat. Appln. No. 10-338658

出 願 人

Applicant(s):

シャープ株式会社

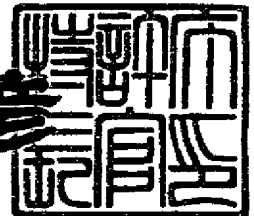
Sharp Kabushiki Kaisha

1999年 9月17日
September 17, 1999

特許庁長官
Commissioner,
Patent Office

近 藤 隆 彦

Takahiko Kondo



出証番号 出証特平11-3062149
Shutsu-sho No. Shutsu-sho-toku-hei 11-3062149

[Document Name]	Petition for Patent
[Reference Number]	98-03481
[Filing Date]	November 30, 1998
[Destination]	To the Commissioner of the JPO
[International Class]	H04N 7/32
[Title of the Invention]	Image Retrieval Information Storing Apparatus and Image Retrieving Apparatus
[Number of Claims]	6
[Inventor]	
[Address]	c/o Sharp Kabushiki Kaisha 22-22, Nagaike-cho, Abeno-ku, Osaka-shi, Osaka
[Name]	Shuichi WATABE
[Applicant]	
[Identification Number]	000005049
[Name]	Sharp Kabushiki Kaisha
[Telephone Number]	06-621-1221
[Attorney]	
[Identification Number]	100103296
[Patent Attorney]	
[Name]	Takaya KOIKE
[Telephone Number]	06-621-1221
[Contact Information]	phone: 043-299-8466 Intellectual Property Center, Tokyo Intellectual Property Division
[Indication of Fee]	

[Deposit Account Number]	012313	
[Fee]	21000	
[List of the Accompanying Documents]		
[Document]	Specification	1
[Document]	Drawings	1
[Document]	Abstract	1
[Number of General Power of Attorney]	9703283	
[Requirement of Proof]	Yes	

[Document Name] Specification

[Title of the Invention] Image Retrieval Information Storing Apparatus and Image Retrieving Apparatus

[Scope of Claims for Patent]

[Claim 1]

An image retrieval information storing apparatus, comprising:
a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data;
a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on said coding information; and
a storing unit storing said coding information and frame feature value in correspondence with each frame of said coded image data.

[Claim 2]

An image retrieval information storing apparatus, comprising:
a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data; and
a storing unit storing said coding information in correspondence with each frame of said coded image data.

[Claim 3]

An image retrieval information storing apparatus, comprising:
a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data;
a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on said coding information; and
a storing unit storing said frame feature value in correspondence with each frame of said coded image data.

[Claim 4]

An image retrieving apparatus, comprising:

an input unit receiving as input, coded image data, prescribed coding information which will be information representing frame feature stored in correspondence with each frame of the image data, and a frame feature value which is a numerical representation of the frame feature based on the coding information;

a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on said coding information;

an index information generating unit determining a featured frame among said image data based on the frame feature value from said input unit or frame feature value generating unit and generating index information which is positional information of said featured frame; and

an output unit outputting an index image based on the index information.

[Claim 5]

An image retrieving apparatus, comprising:

an input unit receiving as input, coded image data and prescribed coding information which will be information representing frame feature stored in correspondence with each frame of the image data;

a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on said coding information;

an index information generating unit determining a featured frame among said image data based on the frame feature value from said frame feature value generating unit and generating index information which is positional information of said featured frame; and

an output unit outputting an index image based on the index information.

[Claim 6]

An image retrieving apparatus, comprising:

an input unit receiving as input, coded image data and a frame feature value which is a numerical representation of frame feature stored in correspondence with each frame of the image data;

an index information generating unit determining a featured frame among said image data based on the frame feature value and generating index information which is positional information of said featured frame; and

an output unit outputting an index image based on the index information.

[Detailed Description of the Invention]

[Technical Field to Which the Invention Belongs]

The present invention relates to generation and storage of image retrieval information used for retrieving a desired image from accumulated plurality of pieces of coded image data and to a method of implementing image retrieval using the image retrieval information.

[Prior Art]

When a motion picture is retrieved, it is important to recognize the contents of the motion picture, that is, what is the object picked up in the motion picture. To that end, except when a text title or description is provided, in most cases it is necessary for the user to confirm the contents by reproducing the whole motion picture. As the number of motion pictures among which a desired one is to be retrieved increases, it becomes harder for a user to reproduce the motion pictures one by one and to confirm the contents thereof, and the efficiency of retrieval is quite poor. Efficiency further lowers when each motion picture is in the form of coded compressed data requiring decoding and reproduction before retrieval. In order to solve this problem, a method of retrieval may be effective in which one or a plurality of frames characteristic of the motion picture, typically representing the contents of the motion picture are extracted and displayed, so that the contents of the motion picture can be displayed in schematic manner.

The characteristic frame (hereinafter referred to as featured frame) used for motion picture retrieval includes, for example, a scene change frame. Japanese Patent Laying-Open No. 9-261648 describes a method in which a scene change frame is extracted, based on prediction mode information included in image data, from image

data coded in accordance with interframe prediction coding. Over one frame, the number of I blocks which are coded in accordance with intraframe prediction, P blocks coded in accordance with forward interframe prediction, B blocks coded in accordance with backward interframe prediction and Bi blocks coded in accordance with bidirectional interframe prediction are counted. Here, as frequency information of these respective blocks reflects correlation among frames in the motion picture, based on the frequency information of each block, a frame immediately following a scene change (= scene change frame) is detected. Further, Japanese Patent Laying-Open No. 10-23421 describes a method of extracting a scene change frame, based on the change in code value of each piece of coding information contained in the coded image data. A conventional image retrieval information storing apparatus in accordance with the prior art is as shown in Fig. 14.

A coding information reading unit 1401 reads, according to Japanese Patent Laying-Open No. 9-261648, block by block prediction mode information from coded image data, and reads, according to Japanese Patent Laying-Open No. 10-23421, respective pieces of coding information of different types. Then, a frame feature value generating unit 1402 calculates, from the various pieces of coding information read by coding information reading unit 1401, frequency of respective prediction mode blocks according to Japanese Patent Laying-Open No. 9-261648, and calculates accumulated value of code value of respective pieces of coding information according to Japanese Patent Laying-Open No. 10-23421. An index information generating unit 1303 determines the scene change frame which is the featured frame, based on the frame by frame feature value obtained in a frame feature value generating unit 1302, that is, frequency information of respective prediction mode blocks according to Japanese Patent Laying-Open No. 9-261648, and accumulated code value of respective pieces of coding information according to Japanese Patent Laying-Open No. 10-23421 and outputs positional information thereof as index information. Finally, an index information storing unit 1404 stores the index information output from index

information generating unit 1403 as image retrieval information. On the other hand, Fig. 15 represents a conventional image retrieving apparatus using the image retrieval information stored in this manner. An image retrieval executing unit 1501 executes actual retrieval using the image retrieval information and the coded image data as inputs and outputs the results of retrieval.

The featured frame includes, in addition to the scene change frame, a scene change frame based on rapid/slow movement, described in Japanese Patent Laying-Open No. 9-284702. According to Japanese Patent Laying-Open No. 9-284702, a motion vector for detecting a scene change frame is independently obtained from the original image, not from the coding information, and the scene change frame is detected based on the total sum of motion vectors in a frame.

[Problems to be Solved by the Invention]

In the above-described conventional image retrieval information storing apparatus, positional information of the extracted featured frame is obtained, and the positional information only is stored as the index information. Therefore, even when a plurality of images which are the objects of retrieval have mutually different features, only a featured frame representing one same feature only can be obtained. If feature frames reflecting features of respective images are to be obtained, it is necessary to go back to the coded image data and generate the image retrieval information. In the process of retrieval, when featured frames corresponding to various features of images which are the object of retrieval are to be taken out in an interactive manner, going back to the coded image data and generating the image retrieval information significantly lowers retrieval efficiency. Further, preparation of featured frame indexes corresponding to every possible feature for all the image data is not practical. Further, it is not possible by the prior art to meet with high efficiency a request for a featured frame which has not been expected by the provider providing the image retrieval information.

The present invention was made in view of these problems, and the present

invention allows adaptive extraction of a featured frame in a process of retrieval by storing coding information utilized for extracting a featured frame or a feature value for each frame for extracting a featured frame.

[Means for Solving the Problems]

According to claim 1 of the present invention, the problem above is solved by including a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data, a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on the coding information, and a storing unit storing the coding information and frame feature value in correspondence with each frame of the coded image data.

According to claim 2 of the present invention, the problem above is solved by including a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data; and a storing unit storing the coding information in correspondence with each frame of the coded image data.

According to claim 3 of the present invention, the problem above is solved by including a coding information reading unit reading prescribed coding information which will be information representing frame feature from coded image data, a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on the coding information, and a storing unit storing the frame feature value in correspondence with each frame of the coded image data.

According to claim 4 of the present invention, the problem above is solved by including an input unit receiving as input, coded image data, prescribed coding information which will be information representing frame feature stored in correspondence with each frame of the image data, and a frame feature value which is a numerical representation of the frame feature based on the coding information, a frame feature value generating unit obtaining a frame feature value which is a numerical

representation of the frame feature, based on the coding information, an index information generating unit determining a featured frame among the image data based on the frame feature value from the input unit or frame feature value generating unit and generating index information which is positional information of the featured frame, and an output unit outputting an index image based on the index information.

According to claim 5 of the present invention, the problem above is solved by including an input unit receiving as input, coded image data and prescribed coding information which will be information representing frame feature stored in correspondence with each frame of the image data, a frame feature value generating unit obtaining a frame feature value which is a numerical representation of the frame feature, based on the coding information, an index information generating unit determining a featured frame among the image data based on the frame feature value from the frame feature value generating unit and generating index information which is positional information of the featured frame, and an output unit outputting an index image based on the index information.

According to claim 6 of the present invention, the problem above is solved by including an input unit receiving as input, coded image data and a frame feature value which is a numerical representation of frame feature stored in correspondence with each frame of the image data, an index information generating unit determining a featured frame among the image data based on the frame feature value and generating index information which is positional information of the featured frame, and an output unit outputting an index image based on the index information.

[Embodiments]

In embodiments of the present invention, a scene change frame and a frame in which rapid movement is locally observed are extracted as feature frames, by way of example, using motion vector information and coding prediction mode information among coding information included in the image data. A case where other coding information is used or a case where other feature frames are to be extracted may also

naturally have a configuration shown in the present invention.

Figs. 1 to 7 show a first embodiment of an image retrieval information storing apparatus and an image retrieving apparatus of the present invention.

Fig. 1 is a configuration diagram representing the first embodiment of the image retrieval information storing apparatus of the present invention. A coding information reading unit 101 receives coded image data as an input, and reads and outputs desired coding information included in the image data. Coding information reading unit 101 in the present embodiment extracts and outputs prediction mode information and motion vector information from the coded image data.

A frame feature value generating unit 102 processes each piece of coding information obtained from coding information reading unit 101, and generates and outputs a feature value for each frame as a reference for determination of a featured frame. Fig. 2 illustrates an internal configuration of frame feature value generating unit 102 in Fig. 1 in the present embodiment.

Coding prediction mode information read by coding information reading unit 101 is assumed as a prediction coding method for each frame and a prediction method for each coding block in the frame. A prediction mode counting unit 201 counts the number of blocks coded in accordance with respective prediction methods, frame by frame. In a forward prediction coding frame (P frame), the number of I blocks coded in accordance with intraframe prediction and the number of P blocks coded in accordance with interframe prediction are counted, respectively. In a bidirectional prediction coding frame (B frame), the number of I blocks coded in accordance with intraframe prediction, the number of P blocks coded in accordance with forward interframe prediction, the number of B blocks coded in accordance with backward interframe prediction and the number of Bi blocks coded in accordance with bidirectional interframe prediction are counted, respectively.

Further, prediction mode counting unit 201 outputs, as block prediction mode frequency information for each frame, the number P_p of P blocks for the P frame, and

the total number $B_f (= P + B_i)$ of forward interframe prediction blocks and total number $B_b (= B + B_i)$ of backward interframe prediction blocks for the B frame.

A frequency information converting unit 202 converts these pieces of frequency information to attribute information for each frame (in the following, the attribute information related to each frame will be referred to as the "frame feature value"). In the present embodiment, each frame feature value is set such that it represents correlation between the frame of interest and an immediately preceding frame.

Fig. 3 shows an example of the relation of reference among P and B frames at the time of interframe prediction coding with an arrow. A starting point of the arrow represents a frame which is an object of coding/decoding, and the end point of the arrow represents a reference frame at the time of coding/decoding. When the reference characters P_p , B_{f1} , and B_{b1} allotted to respective arrows represent the aforementioned frequency information, for example, the frame feature value for frame B2, that is, frequency information related to correlation between frames B1 and B2 should be calculated by a prescribed operation from respective block frequency information P_p , B_{f1} , and B_{b1} allotted here.

In the present embodiment, the frame feature value of frame B2 is the value of B_{f2} when B_{f2} exceeds a certain threshold value, the value of B_{b1} when B_{f2} does not exceed the certain threshold value but B_{b1} exceeds the threshold value, and otherwise the value of B_{f2} or B_{b1} which is larger. The frame feature value of frame B3 is also calculated in the similar manner. As to frame B1, the value of B_{f1} is used as the frame feature value. In addition, as to frame P4, the value of B_{b3} or P_p which is larger is used as the frame feature value of frame P4. Naturally, the method of calculating attribute information for each frame is not limited to this. Further, the frequency information of the coded blocks counted by prediction mode counting unit 201 may be directly regarded as frame feature values.

A motion vector statistic calculating unit 204 calculates an average value of the vector lengths of motion vectors corresponding to P block for the P frame over the

entire frame, based on the prediction mode information obtained by coding information reading unit 101 and an average value of vector lengths of motion vectors corresponding to all the blocks (Bf) coded in accordance with the forward interframe prediction and all the blocks (Bb) coded in accordance with the backward interframe prediction, for the B frame, over the entire frame. The statistics calculated may not be limited to the average value of vector lengths, and different statistics including average vector may be calculated. Further, the motion vector is normalized considering space between an object frame and a reference frame at the time of calculation.

In addition, in the present embodiment, motion vector statistic calculating unit 204 calculates the statistic by using only motion vectors determined as valid by a valid motion vector detecting unit 203. When a camera is moving while being focused on an object, for example, the object and the background of the picked up image may have motion vectors very much different in magnitude or direction. In such a case, valid motion vector detecting unit 203 is used to extract only that motion vector of an area of interest, for example, the area of the object, to utilize the extracted vector for determining magnitude or the like of motion.

Possible method of separating the object area from the background may include a method in which an average of the motion vectors of the entire frame is calculated and the motion vectors out of the average are successively extracted, and a method in which areas are divided into two by clustering. If the contents of the motion picture come to be more complicated as the number of the objects increase, for example, a method of valid motion vector detection in accordance with the complexity may be used. If the image is not of such a nature, the statistic of the motion vector in the entire frame may be calculated, without valid motion vector detection.

A statistic information converting unit 205 converts each of the above-described motion vector statistics obtained by motion vector statistic calculating unit 204 to a frame feature value provided for each frame. Similar to the frame feature value based on the prediction mode information, the frame feature value based on the motion vector

information in the present embodiment is set such that it indicates the motion information between a frame of interest and an immediately preceding frame. At this time, the coding block frequency information obtained by prediction mode calculating unit 201 is referred to in calculating the motion vector frame feature value.

In Fig. 3, regarding the motion vector frame feature value provided to frame B2, a vector length average of all motion vectors corresponding to Bf2 and Bb1 is provided when both of block frequencies Bf2 and Bb1 exceed a certain threshold value, a vector length average of motion vectors corresponding to Bf2 is provided when only Bf2 exceeds the threshold value, a vector length average of motion vectors corresponding to Bb1 is provided when only Bb1 exceeds the threshold value, and otherwise 0 is provided. This is also the case with frame B3. As to frame B1, a vector length average of motion vectors corresponding to Bf1 is provided when Bf1 exceeds a certain threshold value and otherwise 0 is provided. In addition, as to frame P4, a vector length average of (normalized) all motion vectors corresponding to Bb3 and Pp is provided when both of Bb3 and Pp exceed a certain threshold value, a vector length average of motion vectors corresponding to Bb3 is provided when only Bb3 exceeds the threshold value, and otherwise 0 is provided.

Naturally, the method of calculating the motion vector frame feature value for each frame is not limited to the above. The motion vector statistics corresponding to respective blocks described above calculated by motion vector statistic calculating unit 204 may be regarded as motion vector frame statistics frame by frame.

The frame feature value on prediction mode and the frame feature value on motion vector obtained in this manner are output from frame feature value generating unit 102 and stored in prescribed storing locations of frame feature value storing unit 103. The storing location of the frame feature value may be a location corresponding to the coded image data of each frame, for example, and it may be stored as header information of the coded image data of each frame. Alternatively, the frame feature value may be stored as separate data for image retrieval, independent of the coded image

data.

Fig. 4 is a configuration diagram representing a first embodiment of an image retrieving apparatus of the present invention. An index information generating unit 401 receives as input the frame feature value stored in the image retrieval information storing apparatus, extracts a desired featured frame based on the frame feature value of each frame, and generates and outputs as the index information, the positional information of the featured frame.

Fig. 5 illustrates an internal configuration of index information generating unit 401 in Fig. 4 in the present embodiment. According to the input frame feature value on prediction mode related to coding, a scene change frame is determined by a scene change frame determining unit 501. In the present embodiment, the scene change frame is determined by thresholding the frame feature value on prediction modes for coding. By changing the setting of the threshold value or by adding a process when an adjacent frame is determined to be the scene change frame, the scene change frame to be extracted varies.

In the prior art, the process of extracting a scene change frame has been independent of the image retrieval process, and the method of determining and the like have been fixed. In the embodiment of the present invention, the threshold value for determining the scene change or the process of determination is adaptively changed in the process of retrieval in response to a request for extracting a new featured frame output from an image retrieval executing unit 402 in the process of image retrieval, as will be described later. Accordingly, the desired scene change frames are extracted successively. A scene change frame index generating unit 502 generates, as index information, positional information of the scene change frame determined by determining unit 501.

Using the frame feature value on motion vector as an input, a featured frame related to magnitude of motion or the like is determined by a motion featured frame determining unit 503. In the present embodiment, peak position determination is made

based on the frame featured values of motion vectors of neighboring plurality of frames, whereby a frame in which local abrupt movement is observed is determined.

Alternatively, a frame having a magnitude not smaller than a threshold value may be extracted, or a frame of which motion is hardly observed and which is at a relative minimum position, may be extracted as the motion featured frame.

In the prior art, the process of extracting a motion featured frame has been independent of the image retrieval process, and the method of determination and the like have been fixed. The embodiment of the present invention is configured such that the method of determining motion featured frame related to what motion feature is of interest is adaptively changed in the process of retrieval, in response to a request for extracting a new featured frame output from image retrieval executing unit 402 in the process of image retrieval, which will be described later, to successively extract desired motion featured frames. A motion featured frame index generating unit 504 generates, as index information, positional information of the motion featured frame determined by determining unit 503.

The scene change frame index information and motion featured frame index information obtained in this manner are output from index information generating unit 401 and input to image retrieval executing unit 402.

Image retrieval executing unit 402 executes image retrieval based on the input featured frame index information and the coded image data. Positional information of the featured frame is obtained from the featured frame index information, and the corresponding frame is decoded using the coded image data. A person performing retrieval executes retrieval by recognizing the contents of the motion picture by thumbnail display (catalogue display) or respective featured frames displayed successively and searching for a desired image. At this time, when it is determined that the featured frame applied as index information is not suitable for image retrieval being executed or that the featured frame is insufficient, a request for extracting a new featured frame is issued from image retrieval executing unit 402 to index information

generating unit 401. Receiving the request for extracting a new featured frame issued from image retrieval executing unit 402, index information generating unit 401 changes the method of determining featured frames in featured frame determining units 501 and 503, determines a desired featured frame, and outputs the positional information of the featured frame as the index information. The output index information is input to image retrieval executing unit 502, and image retrieval is newly executed.

The advantages of the present first embodiment are as follows. As described with respect to index information generating unit 401, the featured frame on motion pictures, such as the scene change frame and the featured frame on motion, may be extracted differently dependent on the manner of determination, and therefore, physical significance of the frame may differ. For example, a frame in which rapid movement is observed and a frame in which movement is hardly observed are frames of completely different features.

When motion picture retrieval is executed, whether it is the best to display a frame in which rapid movement is observed, or a frame with less movement, or a frame having different features on motion as the featured frame of the motion picture depends on the motion picture which is the object of retrieval, and therefore, it is possible that there is a request for adaptive switching in the process of retrieval. In such a situation, the first embodiment of the present invention can immediately meet the request for switching the featured frame in the process of retrieval, as the image retrieval information is stored in the form of frame feature values.

Alternatively, as shown in Fig. 6, it is also possible to store index information of (predetermined) featured frames together with the frame feature values by adding index information generating unit 401 generating index information of the featured frames and an index information storing unit 601 storing index information. In an example where the frame feature values and featured frame index information are both stored, a request for switching a featured frame in the process of retrieval can be immediately met by using the frame feature value, and high speed retrieval can also be executed by using

fixed index information when there is no request for switching in the process of retrieval.

Fig. 7 shows a configuration of the image retrieving apparatus corresponding to the image retrieval information storing apparatus shown in Fig. 6. In the image retrieving apparatus in Fig. 7, the stored index information and the index information output from index information generating unit 401 are both input to image retrieval executing unit 402 and used for image retrieval.

In the present embodiment, the image retrieval information storing apparatus and the image retrieving apparatus are different apparatuses between which index information and the frame feature values are stored and passed. Such information generated by the image retrieval information storing apparatus may be directly passed to the image retrieving apparatus, and retrieval may be executed on-line.

Figs. 8 to 11 show a second embodiment of an image retrieval information storing apparatus and an image retrieving apparatus of the present invention.

Fig. 8 is a configuration diagram representing the second embodiment of the image retrieval information storing apparatus of the present invention. The first embodiment above is to store the frame feature value of each frame, whereas in the present second embodiment, coding information which is the base for extracting the featured frame read by coding information reading unit 101 is stored in the prescribed storing location of a coding information storing unit 801. By this configuration, what is necessary is simply to read the coding information at the prescribed location, when the featured frame is to be extracted in image retrieval. This improves efficiency as compared with successive reading of the original coded image data. The location for storing coding information may be a position corresponding to the coded image data for each frame, for example, as header information of the coded image data for each frame. Alternatively, the coding information may be stored independent of coded image data, as different data for image retrieval.

Fig. 9 is a configuration diagram representing the second embodiment of the image retrieving apparatus of the present invention. In the image retrieving apparatus

in the first embodiment above, the stored frame feature value is input to index information generating unit 401. In contrast, in the present second embodiment, frame feature value generating unit 102 generating a frame feature value for each frame from the input coding information is added and the frame feature value generated by frame feature value generating unit 102 is input to index information generating unit 401. As the operation of frame feature value generating unit 102, index information generating unit 401 and image retrieval information executing unit 402 is the same as in the first embodiment, the operation is not mentioned.

In the present second embodiment, an image retrieval information storing apparatus is implemented in a simple configuration in which only the coding information necessary for extracting a featured frame is extracted and stored from the original coded image data. In addition, as storage is in a form of the coding information, it is possible to change the method of determining a featured frame based on the frame feature value, and in addition, to change the very method of calculating the frame feature value for extracting the feature frame in the process of retrieval. Thus, more flexible image retrieval is possible.

As in the first embodiment, it is also possible to separately store index information of a (predetermined) featured frame together with coding information necessary for extracting featured frame by adding, to the image retrieval information storing apparatus shown in Fig. 8, frame feature value generating unit 102 generating a frame feature value for each frame, index information generating unit 401 generating index information of featured frame, and index information storing unit 601 storing the index information.

Fig. 10 shows a configuration diagram of this image retrieval information storing apparatus. When coding information and featured frame index information are both stored, a request for switching featured frame in the process of retrieval can be met by obtaining the frame feature value based on the coding information, and in a retrieval without a request for switching, retrieval at high speed utilizing fixed index information

can be performed.

Fig. 11 shows a configuration of an image retrieving apparatus corresponding to the image retrieval information storing apparatus in Fig. 10. In the image retrieving apparatus in Fig. 11, the stored index information and the index information output from index information generating unit 401 are both input to image retrieval executing unit 402 and utilized for image retrieval.

In addition, in the first embodiment and the second embodiment above, the frame feature value for each frame and coding information necessary for extracting the featured frame are each stored. These are not incompatible, and therefore the frame feature value and the coding information necessary for extracting the featured frame may be stored together. Further, the index information, the frame feature value and the coding information necessary for extracting the featured frame may be all stored and utilized at the time of image retrieval.

Figs. 12 and 13 show a third embodiment of an image retrieval information storing apparatus of the present invention.

Fig. 12 is a configuration diagram representing the third embodiment of the image retrieval information storing apparatus of the present invention. The present third embodiment is characterized by including a storing information selecting unit 1201 selecting which information should be stored as image retrieval information, from among index information, the frame feature value and coding information necessary for extracting a featured frame. It is noted that the image retrieval information selected by storing information selecting unit 1201 is not limited to any one of the above, and selection of two or all of the index information, the frame feature value and the coding information necessary for extracting a featured frame may also be permitted, depending on a situation.

In the first embodiment, it has been described that the featured frame for a motion picture such as a scene change frame and a featured frame related to motion may be extracted differently dependent on the manner of determination, and that physical

meaning of the frame may differ. For example, a frame in which rapid movement is observed and a frame in which movement is very small are frames having completely different features. When motion picture retrieval is executed, whether it is appropriate to display a frame with rapid movement, or a frame with less movement, or different frame having different feature related to motion as the featured frame for the motion picture depends on the motion picture which is the object of retrieval, and there may be a request for adaptive switching in the process of retrieval. In such a situation, the request for switching in the process of retrieval may be immediately met when the image retrieval information is stored in the form of frame feature value or in the form of coding information, by storing information selecting unit 1201.

Alternatively, when there is some knowledge of the motion picture which is the object of retrieval in advance and appropriate featured frame has been known, it is possible by storing the image retrieval information in the form of index information of the featured frame by storing information selecting unit 1201, to reduce the amount of information for image retrieval, and to execute retrieval at high speed. Further, when the frame feature value or the coding information, and the index information of the featured frame are to be stored together by storing information selecting unit 1201, it is possible to meet the request for switching in the process of retrieval immediately, and to execute retrieval at high speed.

Fig. 13 shows the third embodiment of the image retrieving apparatus of the present invention. The index information, the frame feature value or the coding information necessary for extracting a featured frame stored in the image retrieval information apparatus is input to the image retrieving apparatus as appropriate.

When there is index information, the position of the featured frame is obtained based on the index information, the input coded image data is decoded and displayed, and the image retrieval is executed. When a new featured frame is required in the process of image retrieval and there is the frame feature value, the new featured frame is extracted based on the frame feature value, and the index information is generated and

used for image retrieval.

When it is determined that the frame feature value is inappropriate and there is coding information, a new frame feature value is generated based on the coding information, the new featured frame is extracted from thus generated new frame feature value, and index information is generated and used for image retrieval.

The advantage of storing both the frame feature value and the coding information is that image retrieval with such a high degree of freedom is possible.

When there is coding information and not the input frame feature value, the request for extracting a new featured frame is directly issued to frame feature value generating unit 102.

In this manner, in the third embodiment of the image retrieval information storing apparatus of the present invention, the information to be stored is selected by storing information selecting unit 1201 dependent on the nature of the image which is the object of retrieval so that appropriate image retrieval information can be stored and adaptive image retrieval can be executed by the image retrieving apparatus. Further it is also possible to select the stored information of storing information selecting unit 1201 dependent on the rate of execution of retrieval or by the restriction of storing capacity.

As to the capacity of image retrieval information, the index information, the frame feature value and coding information have capacities larger in this order. For example, when the storage capacity for storing image retrieval information is small, only the index information having small capacity is stored. In a terminal where the storing capacity is sufficiently large and the rate of executing retrieval is slow, all the information is stored to ensure degree of freedom of retrieval, and index information is fully made use of so as not to lower the execution rate.

Further, it is possible to limit the image retrieval information to be stored to only two of the index information, frame feature value and the coding information necessary for extracting featured frame, and to select the stored information by storing information

selecting unit 1201.

[Effects of the Invention]

With the configuration as described above, the image retrieval information storing apparatus according to the invention described in claim 1 of the subject application can store the coding information necessary for extracting the featured frame or the frame feature value for each frame, so that it can immediately meet the request for switching the featured frame in the process of retrieval.

With the configuration as described above, the image retrieval information storing apparatus according to the invention described in claim 2 of the subject application stores the coding information necessary for extracting the featured frame, so that the configuration of a storage side can be simplified and a used capacity of a storage medium can be reduced.

With the configuration as described above, the image retrieval information storing apparatus according to the invention described in claim 3 of the subject application can store the frame feature value necessary for extracting the feature frame, so that it can perform retrieval processing at high speed in response to various retrieval requests.

With the configuration as described above, the image retrieving apparatus according to the invention described in claim 4 of the subject application can adaptively perform image retrieval and perform retrieval processing at high speed based on the frame feature value, by extracting the input coding information or the frame feature value and a new featured frame in response to a featured frame extraction request issued in the process of execution of image retrieval.

With the configuration as described above, the image retrieving apparatus according to the invention described in claim 5 of the subject application can perform flexible image retrieval by changing the very method of calculating the frame feature value for extracting the featured frame in the process of retrieval when there is a new retrieval request for generating the frame feature value based on the input coding

information.

With the configuration as described above, the image retrieving apparatus according to the invention described in claim 6 of the subject application can perform retrieval processing at high speed for extracting the featured frame based on the input frame feature value and achieve a reduced used capacity of a storage medium.

[Brief Description of the Drawings]

Fig. 1 represents a first embodiment of an image retrieval information storing apparatus of the present invention.

Fig. 2 represents an internal configuration of a frame feature value generating unit in the first embodiment of the image retrieval information storing apparatus of the present invention.

Fig. 3 represents reference relation of frames in prediction coding method.

Fig. 4 represents a first embodiment of an image retrieving apparatus of the present invention.

Fig. 5 represents an internal configuration of an index information generating unit in the first embodiment of the image retrieving apparatus of the present invention.

Fig. 6 represents the first embodiment of an image retrieval information storing apparatus of the present invention.

Fig. 7 represents the first embodiment of the image retrieving apparatus of the present invention.

Fig. 8 represents a second embodiment of the image retrieval information storing apparatus of the present invention.

Fig. 9 represents a second embodiment of the image retrieving apparatus of the present invention.

Fig. 10 represents the second embodiment of the image retrieval information storing apparatus of the present invention.

Fig. 11 represents the second embodiment of the image retrieving apparatus of the present invention.

Fig. 12 represents a third embodiment of the image retrieval information storing apparatus of the present invention.

Fig. 13 represents a third embodiment of the image retrieving apparatus of the present invention.

Fig. 14 represents an image retrieval information storing apparatus of the conventional art.

Fig. 15 represents an image retrieving apparatus of the conventional art.

[Description of the Reference Characters]

- 101, 1401 coding information reading unit
- 102, 1402 frame feature value generating unit
- 103 frame feature value storing unit
- 201 prediction mode counting unit
- 202 frequency information converting unit
- 203 valid motion vector detecting unit
- 204 motion vector statistic calculating unit
- 205 statistic information converting unit
- 401, 1403 index information generating unit
- 402, 1501 image retrieval executing unit
- 501 scene change frame determining unit
- 502 scene change frame index generating unit
- 503 motion featured frame determining unit
- 504 motion featured frame index generating unit
- 610, 1404 index information storing unit
- 801 coding information storing unit
- 1201 storing information selecting unit

FIG. 1

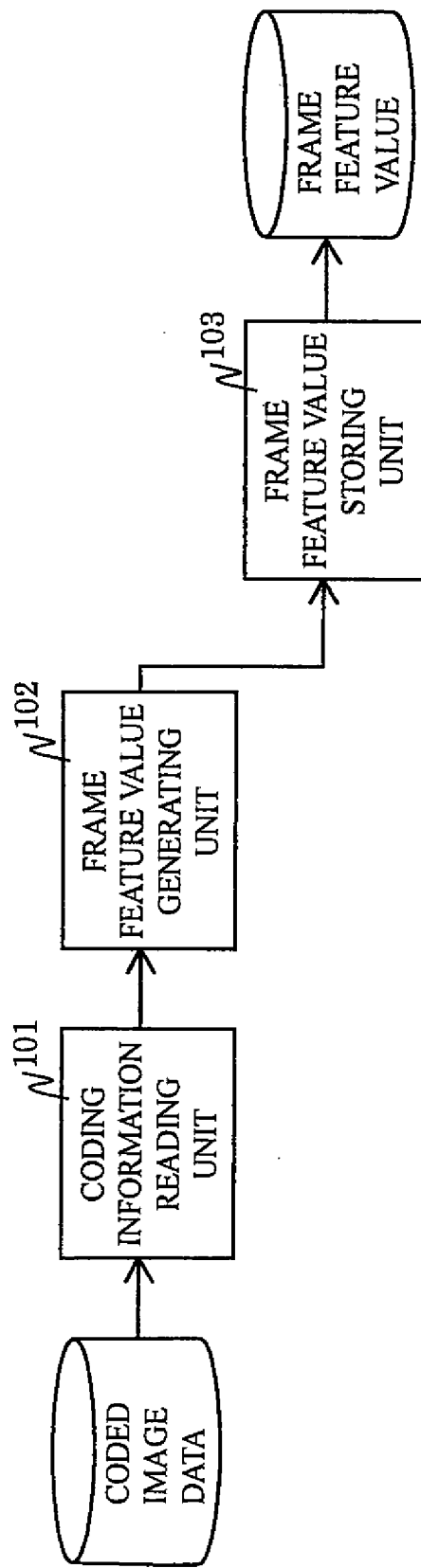


FIG. 2

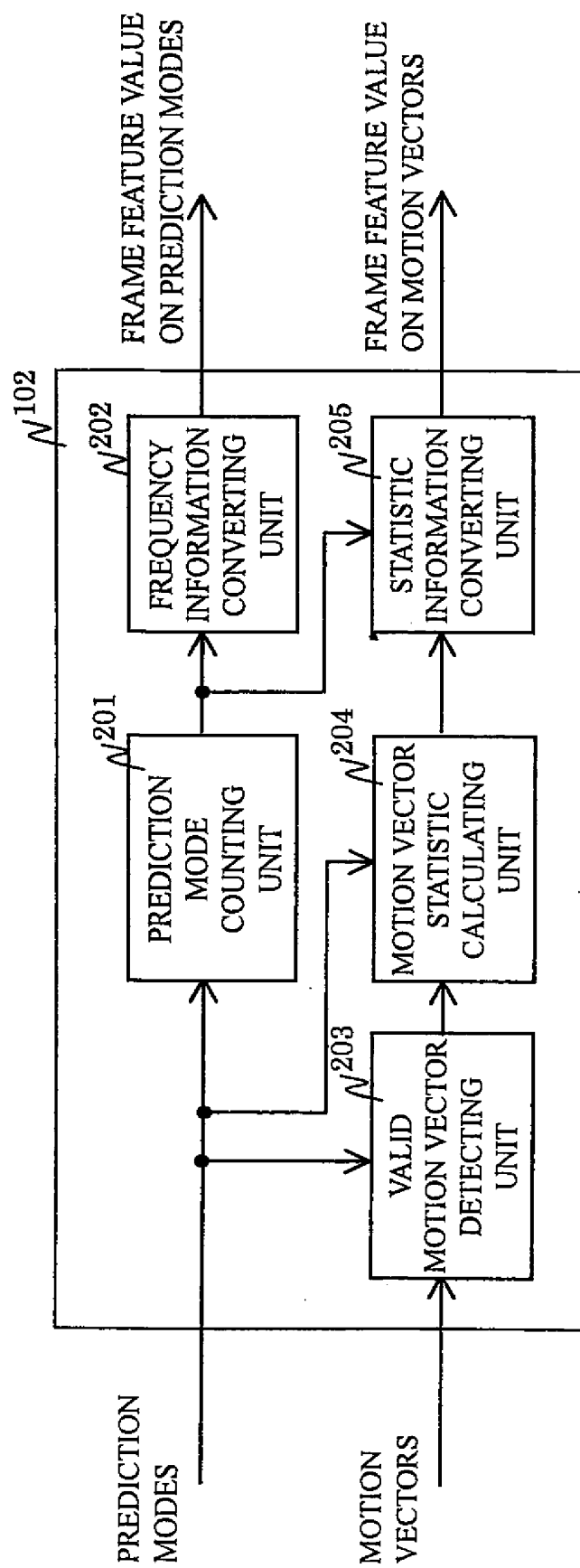


FIG. 3

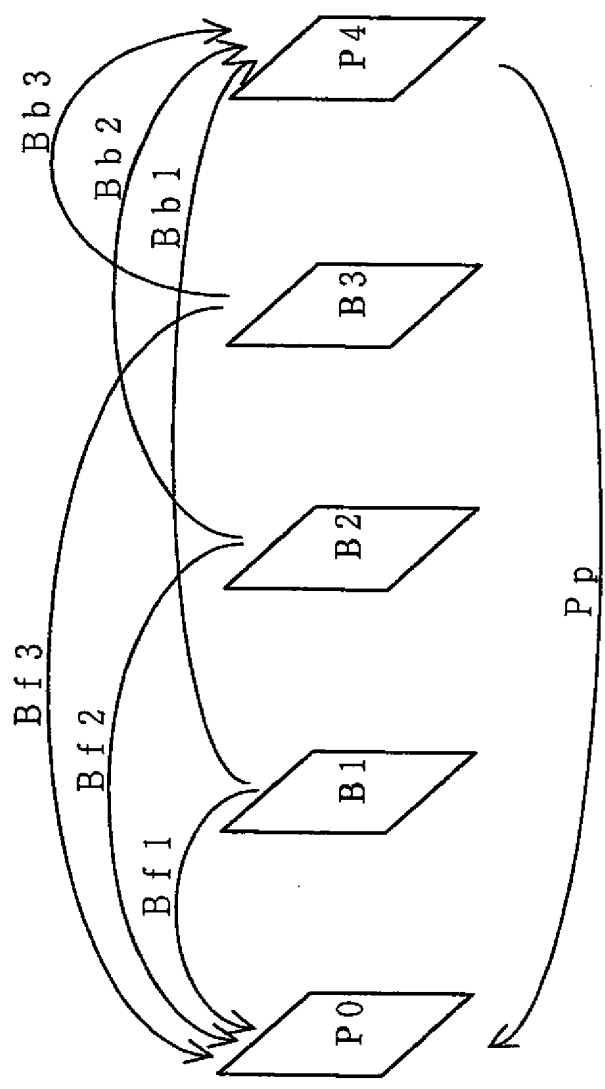


FIG. 4

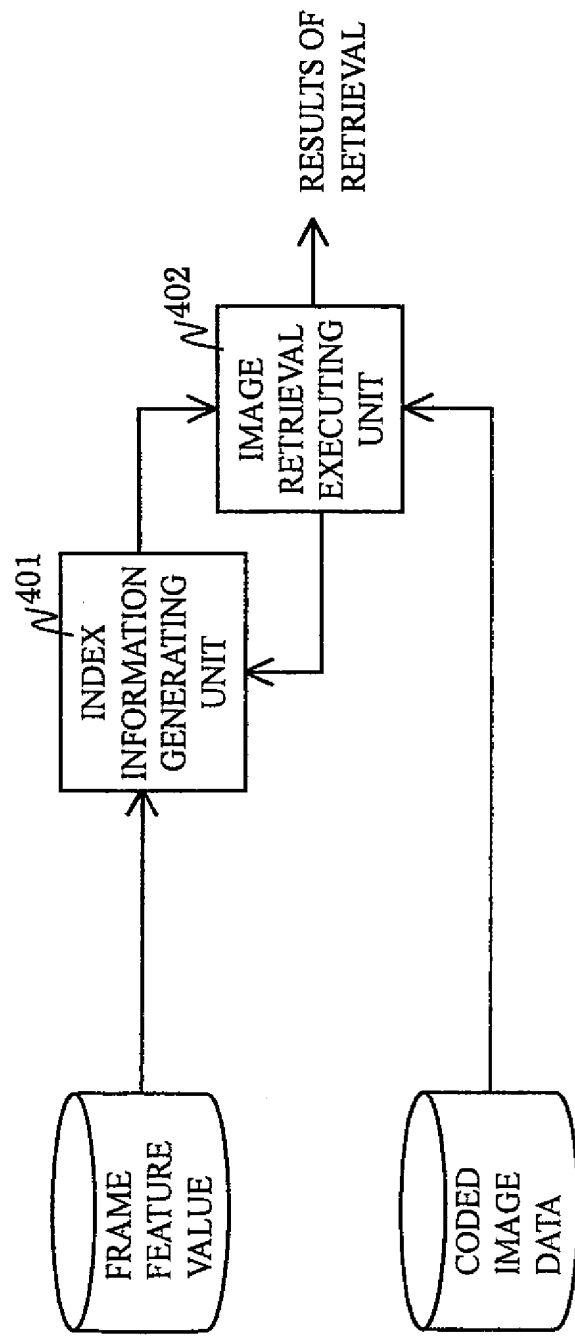


FIG. 5

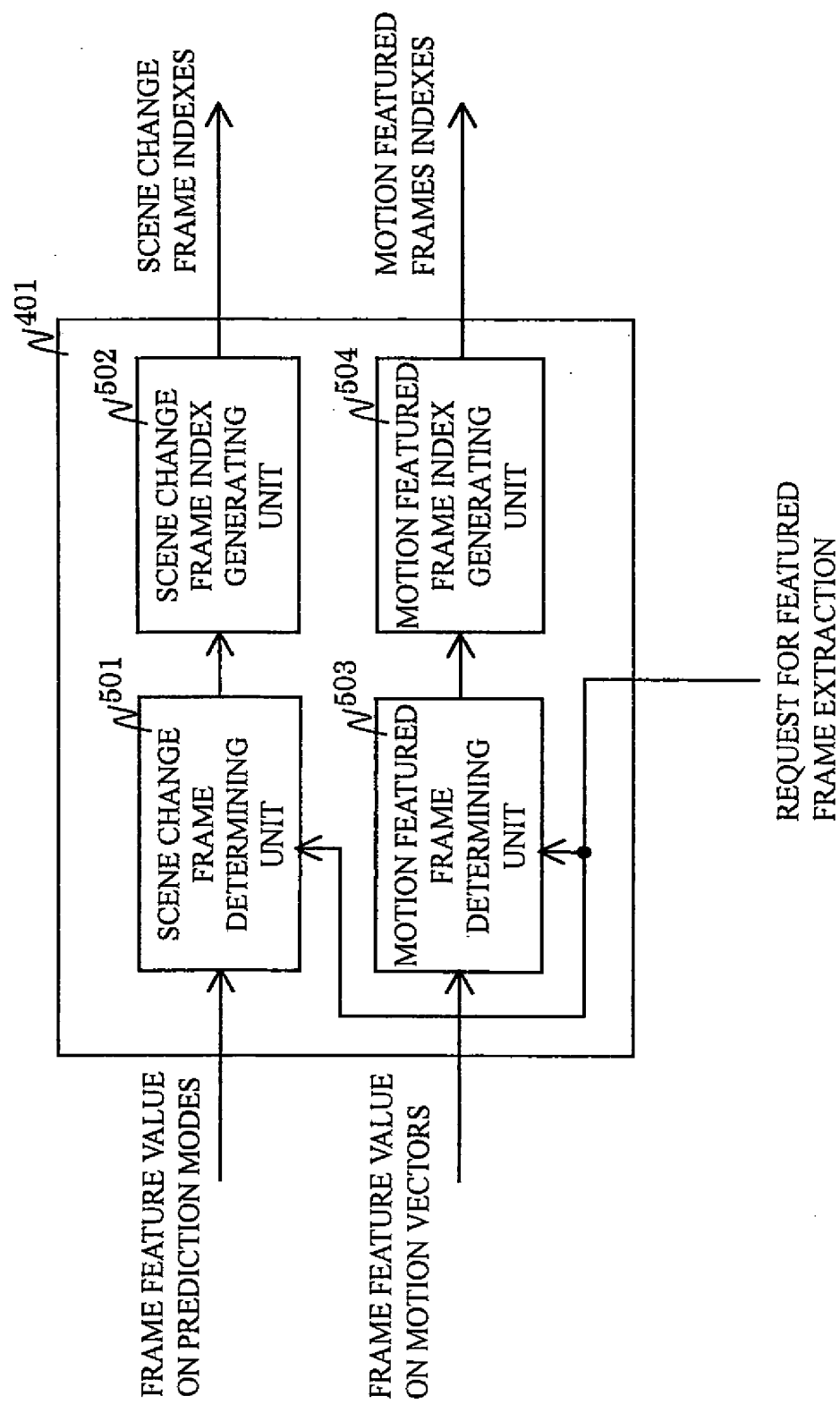


FIG. 6

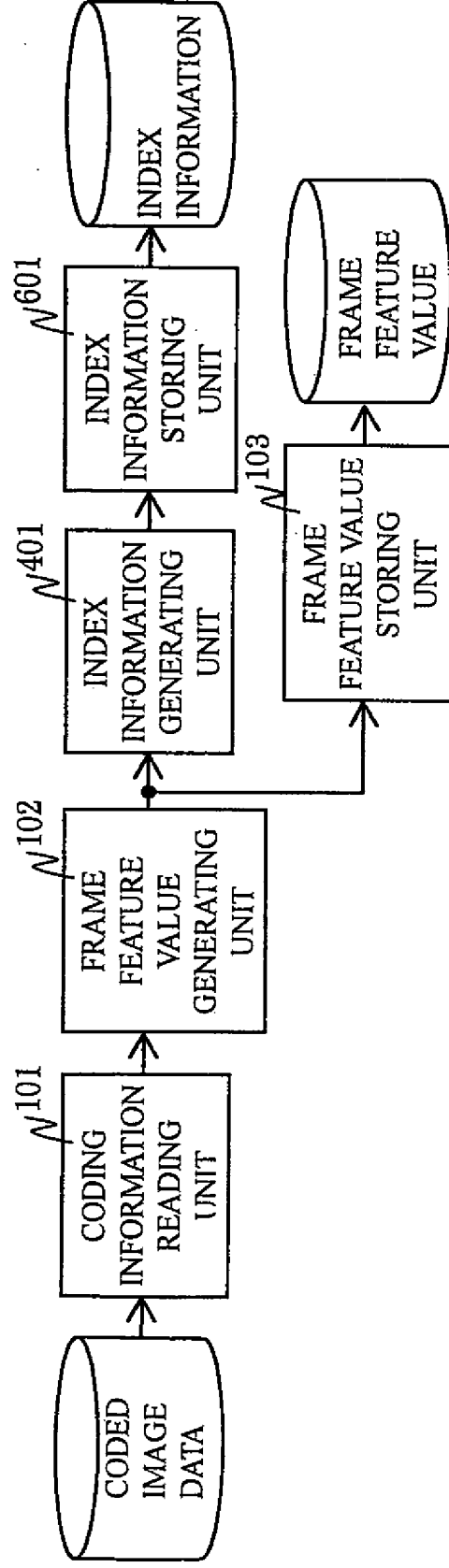


FIG. 7

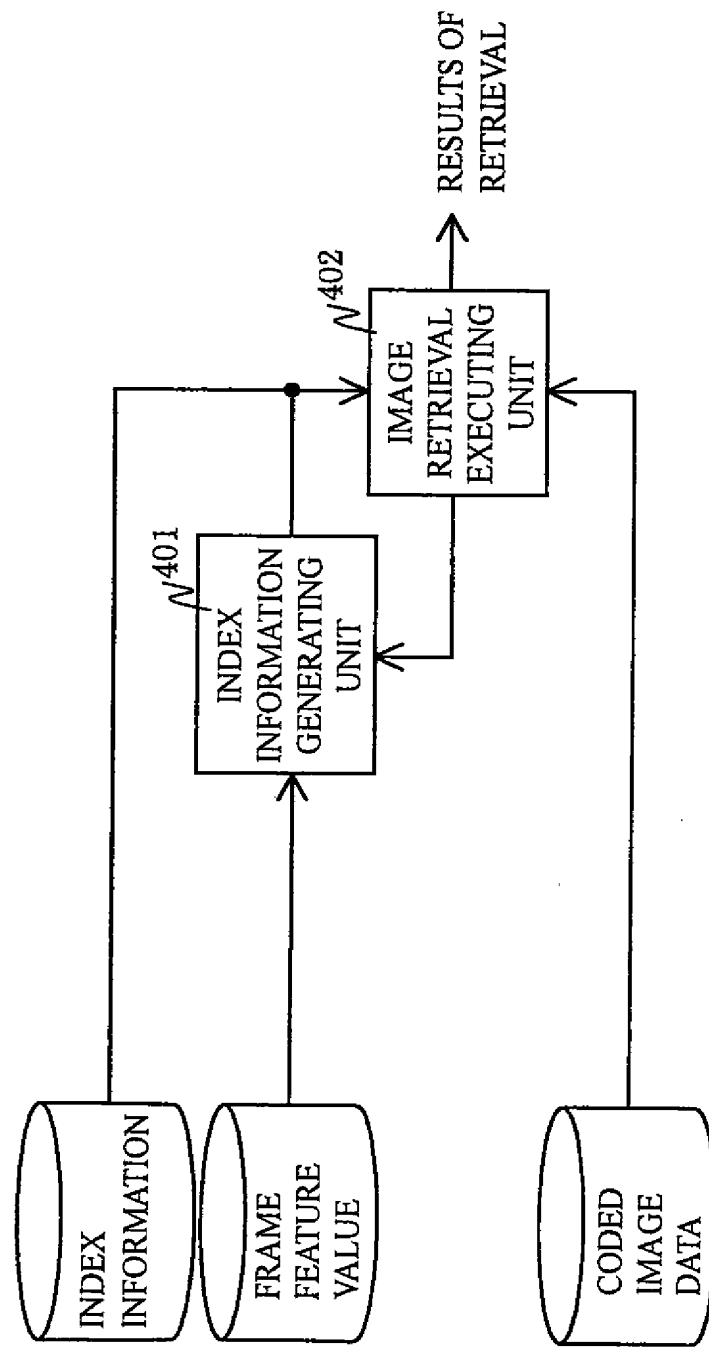


FIG. 8

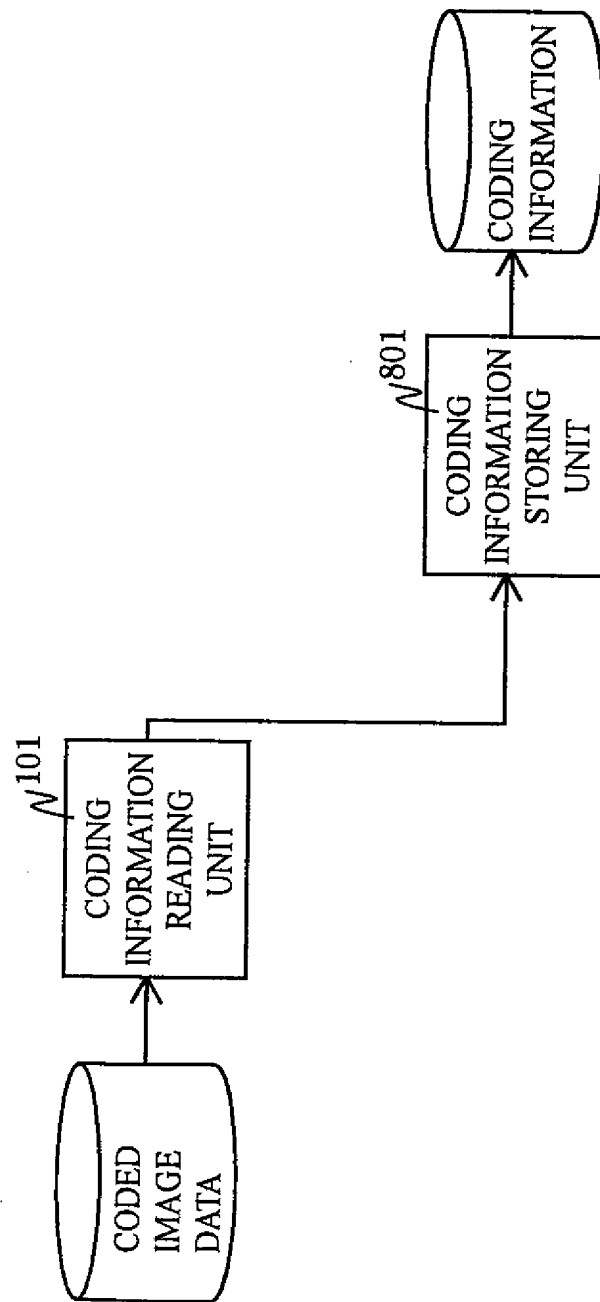


FIG. 9

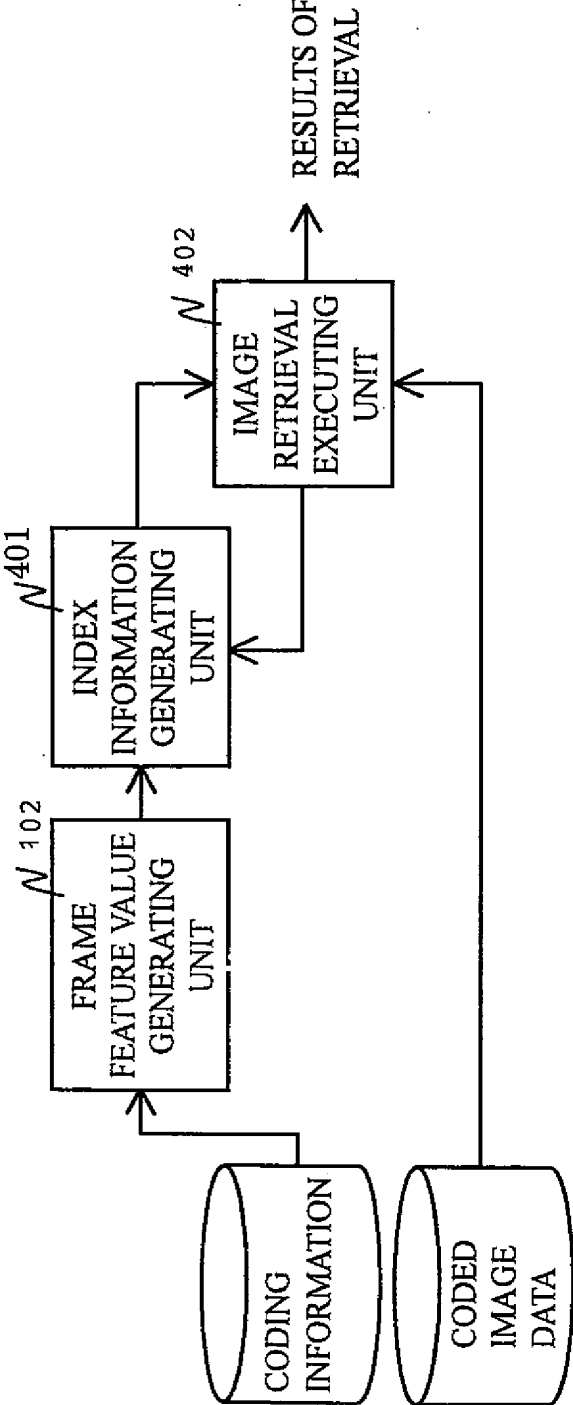


FIG. 10

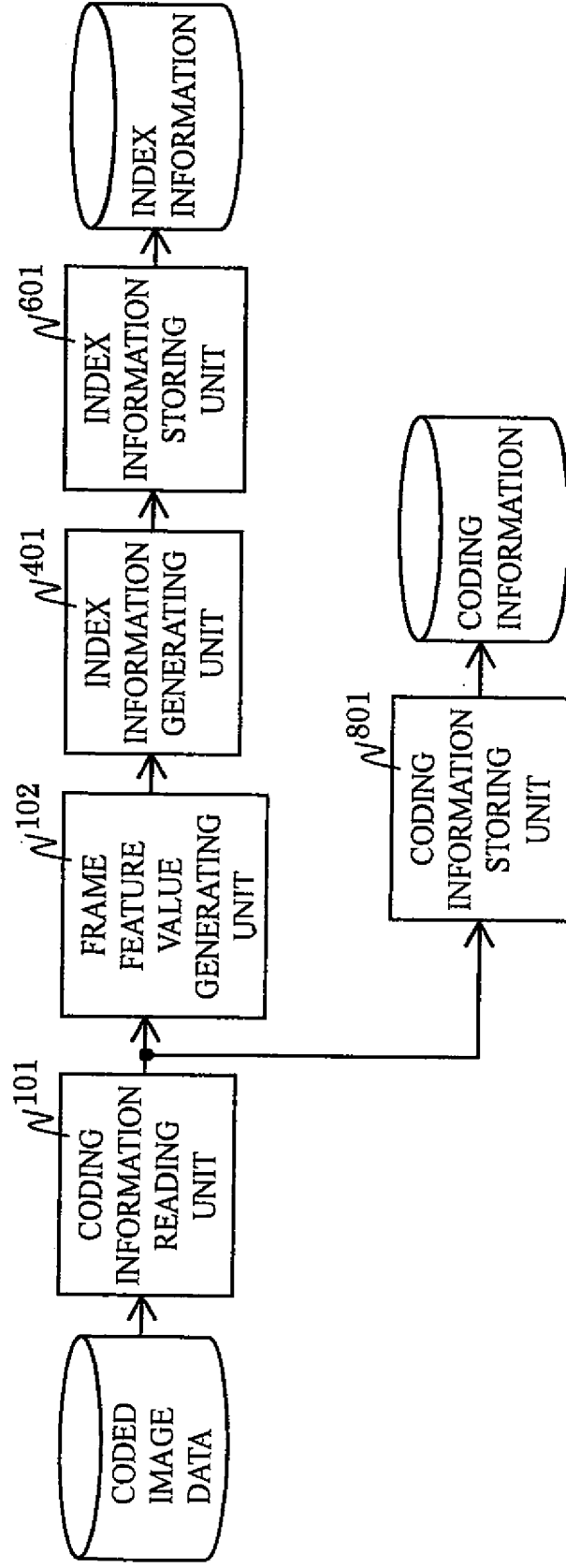


FIG. 11

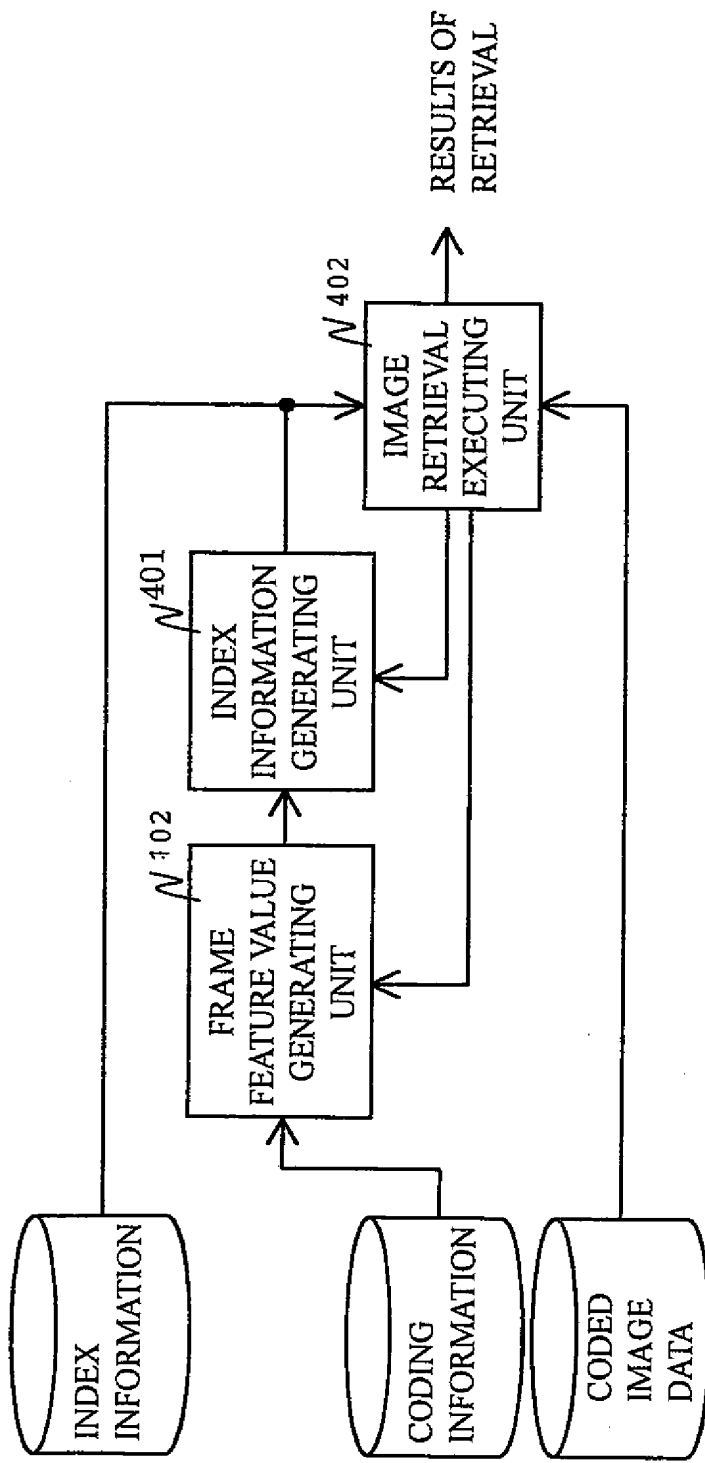


FIG. 12

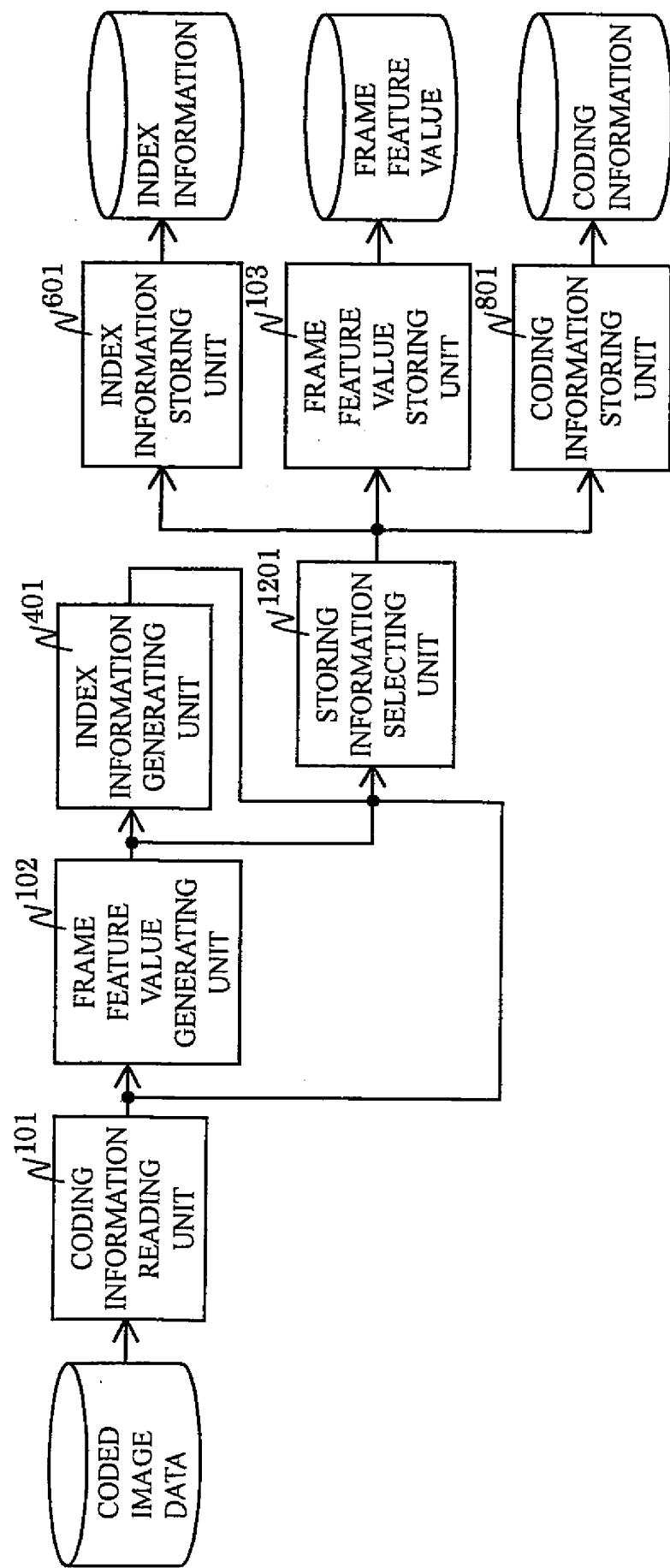


FIG. 13

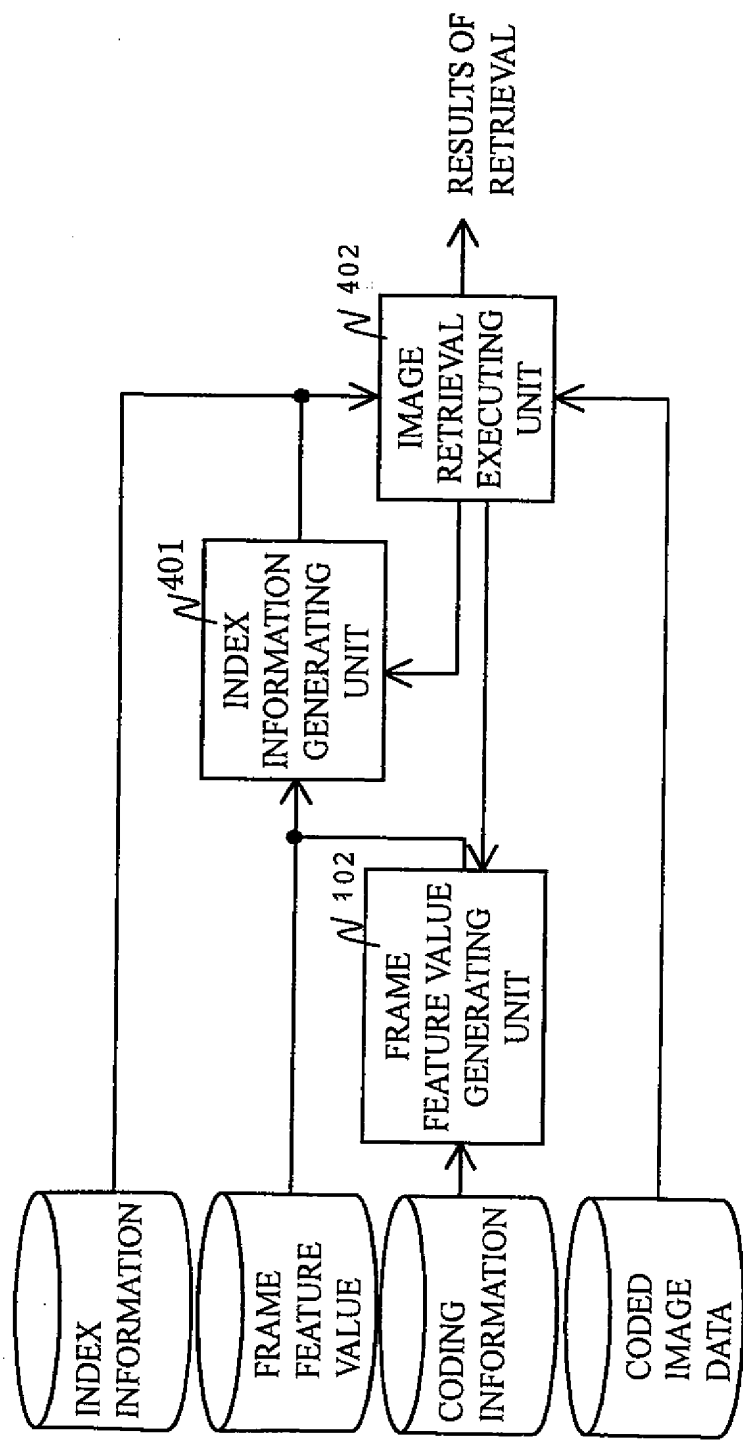


FIG. 14

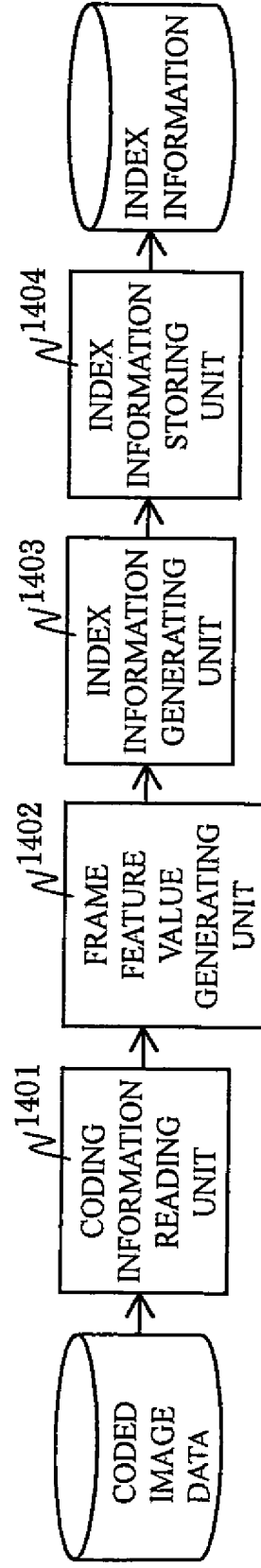
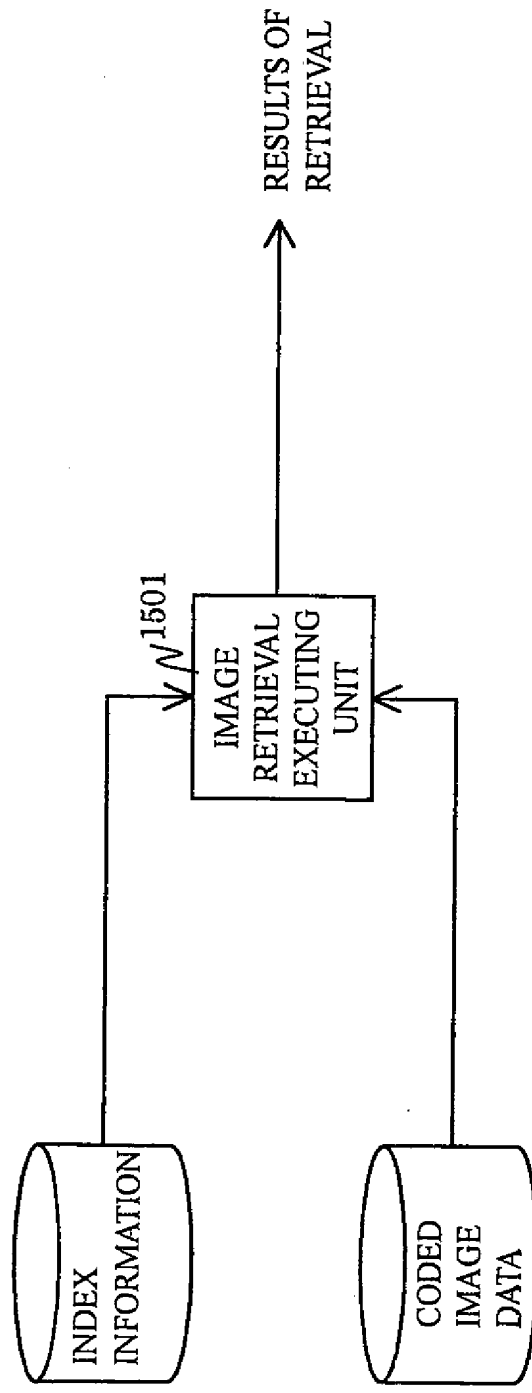


FIG. 15



[Document Name] Abstract

[Abstract]

[Subject] To provide an image retrieval information storing apparatus and an image retrieving apparatus that can quickly and adaptively respond when a different featured frame depending on a situation is requested in a process of image retrieval.

[Solving Means] An image retrieval information storing apparatus is provided with a frame feature value generating unit 102 generating a feature value for each frame which serves as a direct reference for determining a featured frame based on coding information included in coded image data, and a storing unit 103 storing the frame feature value as image retrieval information. An image retrieving apparatus is provided with an index information generating unit determining a featured frame based on the stored feature value for each frame and generating index information based on positional information of the featured frame.

[Selected Drawing] Fig. 1